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# **Weight And Power Calculator Summary of Government White Paper**

**17 September 2004**

# 1. HOPS/PPC Functionality

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- The WPC shall retain the functionality of the existing HOPS and PPC applications, including automating the transfer of ambient and aircraft state information between the Route Object and the WPC, preparing and printing aircraft-specific pre-flight performance forms in accordance with NATOPS (Navy), ATM/TM (Army), and T.O. (Air Force) using Flight Performance Models (FPM) to calculate required performance parameters. The WPC shall, as a minimum, provide the following capabilities as applicable:

Green Text – Understood, in original task statement

Orange Text – Understood, not in original task statement

Magenta Text – Need to do further research to assess task feasibility

Red Text – Open Issues

# 1. HOPS/PPC Functionality

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- **a. Retain all existing configurability and capability of Navy HOPS and Army PPC, including user selectable conservatism factors, user-selectable bypass of limitations, accessory losses, engine/transmission settings, drag values, and other parameters appropriate to helicopter operations**
- **b. Calculate performance information based on appropriate service standardization guidance supplemented by service directives and messages[satisfied by FPMs ]**
- **c. Print weight forms and performance forms in accordance with service documents to include all customized parameters such as engine and limit settings**
- **Stand-alone capability (to allow fulfillment of the reporting requirement without route connectivity)**

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## 2. Flight Performance Information

- **The WPC shall augment the “as planned” flight performance information within JMPS, providing supplemental calculations to support contingency planning and “what-if” scenario evaluation. The WPC shall permit the user to access the internal details of the route, legs, points, commands, and transitions, providing visibility into changes to aircraft state that affect flight performance. The WPC shall allow the user to associate supplemental performance calculations with any points along the route. The WPC shall, as a minimum, provide the following capabilities as applicable:**

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## 2. Flight Performance Information

- a. **Calculate point performance at user defined conditions**
- b. **Calculations between waypoints, not just at waypoints (e.g., takeoff from a turn point, landing at a turn point) [Point calculation (not in the planned route) initiated by user, such as program tool (or user manually select) to pick up highest elevation point in designated areas, heaviest weight point, highest temperature? Need to clarify.]**
- c. **Optionally populated from/to the route or manually overridden**
- d. **Write-to-route capability**
- e. **Ability to transfer hover height and other parameters to route**
- f. **Ask the user to validate transfer of each of the parameters to the route**
- g. **Hover and cruise calculator information**
- h. **Engine inoperative performance options [emergency] (including two engine for three engine platforms)**
  - • **Maximum torque available**
  - • **Minimum and maximum airspeed with and without expendables**
  - • **Maximum rate of climb and endurance airspeed without expendables**
- i. **Time limited events, such as 10 minute power for only 10 minutes; no more**

## 2. Flight Performance Information

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- **j. Critical performance parameters**
  - • **Maximum torque available**
  - • **Torque required**
  - • **HIGE/HOGE load margins in pounds**
  - • **Minimum and maximum VH**
  - • **Maximum rate of climb and endurance airspeed**
  - • **Maximum range airspeed**
  - • **Rate of climb at input airspeed**
  - • **IGE maximum torque available and torque required**
  - • **OGE maximum torque available and torque required**
  - • **OGE vertical rate of climb (VROC)**
  - • **Height/velocity avoidance area**
  - • **Turn radius at input condition**
  - • **Power assurance check and engine health indication test**

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## 2. Flight Performance Information

- a. **Specialized mission calculations**
- • **Sled operations power required and fuel flow**
- ∇ • **Vertrep** [take out this item per TIM discussion]
- ∇ • **ASW** [take out this item per TIM discussion]
- ∇ • **Air-to-air refueling** [take out this item per TIM discussion]
- • **Takeoff:**
  1. **Rolling takeoff**
  2. **Level acceleration**



## 2. Flight Performance Information

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- **l. Optimizations** [single computation only, not along a route]:
  - • Duration in hours/minutes for hover or cruise calculations, given fuel available
  - • Endurance in hours at best cruise endurance airspeed
  - • Maximize payload, given distance
  - • Max range in nautical miles, at max range airspeed
  - • Maximize range, given payload
  - • Minimize fuel required, given payload and range to objective and/or time on station [consider bingo fuel requirements]
- **m. E-6B calculations** [including wind triangle, time/speed/distance/fuel flow/fuel interchangeable solution, and conversions] [to be clarified by Army/Navy/Marin if this is required]
- **n. Alternate point not on current route** [input via coordinates or heading/distance]
  - o. Factor in environmental conditions for each “What-If?” calculation [headwinds, temperature, ...]



### 3. User Interface

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- **The WPC shall provide an intuitive, user-tailorable** [to be clarified, is this in what if condition?] interface to the flight performance calculations within JMPS, including a, **Point View**, and **Form View**. The **Route View shall Route View** provide an overview of “as planned” and “what if” performance calculations for the route as a whole, allowing rapid assessment of portions of the route at which performance may be critical. The Point View shall provide the details of “as planned” and “what-if” calculations at the designated point (including legs, commands, and transitions), and shall allow the route to be modified (edited). The Form View shall display and print aircraft-specific forms relating to flight performance, per NATOPS, ATM/TM, and T.O. instructions and format. **The WPC shall provide intuitive indication of marginal capabilities, limitations**, [indicated in the TIM that PPC is running these] and exceedances, and shall display any **FPM error and warnings messages associated with such calculations**. The WPC shall, as a minimum, provide the following capabilities as applicable:

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- a. **Selectable views:**
  - • **Tree view** [to be clarified what this is]
  - • **Route view**
  - • **Point view**
  - • **Form view**
- b. **Provide extensible GUI that allows user-defined specific layout [show/hide columns]**
- c. **Declutter/Prioritization of displays [expand/collapse rows]**
- d. **Tabular route view so that the pilot can quickly identify and access performance critical areas in the route.**
- e. **Messaging [FPMs will provide] :**
  - • **Provide error messaging and reference to operational publications [NATOPS, ATM/TM, and T.O.]**
  - • **Display appropriate alerts for time limited events**
    - **Parameter exceedance alert with user-definable views and filters**
      - **Graphical/analog symbols and colors to show alerts/exceedances**

### 3. User Interface

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- **f. Single point: both arriving at, and departing from the point [Is this tied to what if?]**
- **g. Power margins displayed depending on entry or exit [Is this tied to what if/configuration editor?]**
- **h. Visibility into JMPS calculations [before, after, average] [Remove]**
  - i. Small-screen capable [simple view, large characters] for portable kneeboard platforms [ Looks like hardware limitation, Is it required?]**

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## 4. Weight, Drag, and Configuration

The WPC shall provide the weight, drag, and configuration-specific information needed to complete required performance calculations. The WPC shall, as a minimum, provide the following capabilities as applicable [**Does current Configuration Editor satisfy these?**]:

- a. Weight and drag values [performance calculations in first phase, cg calculations in subsequent design]
- b. Define consistent terminology between different service procedures [Doesn't look like a JMPS requirement. Any organization will give that to NGMS?]
- c. Weight buildup calculations
- d. Distinguish stores drag from other configuration drag for helicopter performance planning
- e. Input data from Navy/Army/Air Force weight documents and databases in standard format [AWBS]